Having described the invention, that which is claimed is:

CLAIMS

1. A method of making a water soluble polymer of an acrylic acid compound comprising:

combining an acrylic acid compound with a reactant selected from the group consisting of a divalent metal salt of said acrylic acid compound, a monovalent metal salt of said acrylic acid compound and mixtures thereof to form a polymer precursor,

combining a polymerization initiator with said precursor and

permitting said precursor to form said water soluble polymer;

wherein

said polymer precursor contains in the range of from about 0.65 to about 2.75 units of said divalent metal salt of said acrylic acid compound per unit of said acrylic acid compound and in the range of from about 0 to about 2.25 units of said monovalent metal salt of said acrylic acid compound per unit of said acrylic acid compound, and

said acrylic acid compound is represented by the formula CH_2=CRH-COOH and R is hydrogen or a methyl group.

2. The method of claim 1 wherein said polymerization initiator is a free radical initiator.

3. The method of claim 2 wherein said water soluble polymer is combined with a cross linking agent to form a gel which is not water soluble and is stable at temperatures up to about 450 degrees Fahrenheit.

4. The method of claim 3 wherein said cross linking agent is a compound containing a trivalent metal.

5. The method of claim 3 wherein said cross linking agent is a compound containing chromium having a valence of + 3.

6. The method of claim 2 wherein said acrylic acid compound is acrylic acid, said divalent metal salt is magnesium acrylate and said monovalent metal salt is an alkali metal acrylate.

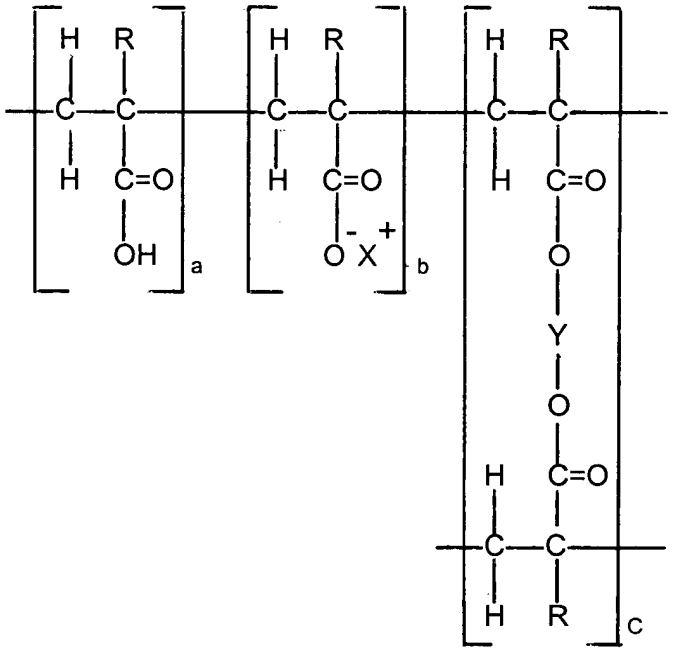
7. The method of claim 5 wherein said divalent metal salt is the reaction product of acrylic acid and a magnesium compound selected from magnesium oxide, magnesium hydroxide and magnesium carbonate and said monovalent metal salt is the reaction product of acrylic acid and a sodium compound selected from sodium oxide, sodium hydroxide and sodium carbonate.

8. The method of claim 7 wherein said cross linking agent is chromium acetate, said sodium compound is sodium hydroxide and said magnesium compound is magnesium hydroxide.

9. The product of the method of claim 6.

10. The product of the method of claim 8.

11. A composition of matter represented by the formula



wherein

R is independently H and -CH_3; X is Na, K, Li, Rb, Cs, or NH_3; Y is Be, Mg, Ca, Sr, B or Zn; a is 1, b has a value in the range of from 0 to about 2.25 and c has a value in the range of from about 0.65 to about 2.75.

12. A method of making a water soluble polymer comprising:

forming a polymer precursor by mixing an acrylic acid compound with a material selected from the group consisting of a divalent metal compound, a monovalent metal compound and mixtures thereof,

combining a polymerization initiator with said precursor, and

permitting said precursor to form said water soluble polymer;

wherein

the ratio of said monovalent metal compound to said acrylic acid compound in said precursor is an amount in the range of from about 0 to about 0.5 moles of said monovalent metal compound per mole of said acrylic acid compound and the ratio of said divalent metal compound to said acrylic acid compound in said precursor is an amount in the range of from about 0.15 to about 0.5 moles of said divalent metal compound per mole of said acrylic acid compound;

said acrylic acid compound is represented by the formula CH_2=CRH-COOH wherein R is hydrogen or a methyl group;

said monovalent metal compound is represented by the general formula X_NM and said divalent metal compound is represented by the general formula YM_Z wherein Y is beryllium, magnesium calcium, strontium, barium or zinc; X is sodium, potassium, lithium, rubidium, cesium or an ammonia group; M is oxygen, a hydroxide group or a carbonate group; $_Z$ is 1 or 2, and $_N$ is 1 or 2.

13. The method of claim 12 wherein R is hydrogen, X is sodium, Y is magnesium, M is a hydroxide group, $_Z$ is 2, and $_N$ is 1.

14. A method of adjusting the permeability of a subsurface formation to regulate the flow of water in said formation, said method being comprised of the steps of introducing into said subsurface formation a gel which is not water soluble and is stable at temperatures up to about 450 degrees Fahrenheit, wherein said gel is made by the steps of

combining an aqueous solution of acrylic acid with a reactant selected from the group consisting of an alkaline earth metal salt of acrylic acid, an alkali metal salt of acrylic acid and mixtures thereof to form a polymer precursor,

combining a polymerization initiator with said precursor and permitting said precursor to form a water soluble polymer and thereafter,

combining said water soluble polymer with a cross linking agent to form said gel; wherein

said acrylic acid, said alkaline earth metal salt and said alkali metal salt are combined in a ratio in the range of from about 0.65 to about 2.75 units of said alkaline earth metal salt per unit of said acrylic acid and in the range of from about 0 to about 2.25 units of said alkali metal salt per unit of said acrylic acid.

15. The method of claim 14 wherein said alkaline earth metal salt is magnesium acrylate and said alkali metal salt is sodium acrylate.

16. A method of adjusting the permeability of a subsurface formation to regulate the flow of water in said formation, said method being comprised of the steps of introducing into said subsurface formation a gel which is not water soluble and is stable at temperatures up to about 450 degrees Fahrenheit, wherein said gel is made by the steps of

forming a polymer precursor by mixing acrylic acid with a material selected from the group consisting of magnesium hydroxide, sodium hydroxide and mixtures thereof,

combining a polymerization initiator with said precursor and permitting said precursor to form a water soluble polymer and thereafter,

combining said water soluble polymer with a cross linking agent to form said gel; wherein

the ratio of said sodium hydroxide to said acrylic acid in said precursor is an amount in the range of from about 0 to about 0.5 moles of said sodium hydroxide per mole of said acrylic acid and the ratio of said magnesium hydroxide to said acrylic acid in said precursor is an amount in the range of from about 0.15 to about 0.5 moles of said magnesium hydroxide per mole of said acrylic acid.